www.wvara.org November 2020

The Heterodyne

Newsletter of the West Valley Amateur Radio Association

November Meeting via Zoom

Russian Woodpecker Over the Horizon Radar – A Real Blast from the Past by Keith Snyder, KI6BDR

Wednesday, November 11
Meeting Starts at 7pm
Visitors Are Welcome!

Due to the coronavirus, there will not be a meeting at American Red Cross.

WVARA Repeaters (W6PIY)

Band	Frequency	PL
6 Meters	52.580- MHz	151.4 Hz
2 Meters	147.39+ MHz	151.4 Hz
1.25 Meters	223.96- MHz	156.7 Hz
0.70 Meter	441.35+ MHz	88.5 Hz
0.23 Meter	1286.2- MHz	100 Hz

Club Net

WVARA's club net is on the W6PIY repeaters each Tuesday at 8:30 pm. All repeaters are linked together during the net. The net script can be found at www.wvara.org/net.html .

Zoom Meeting Information

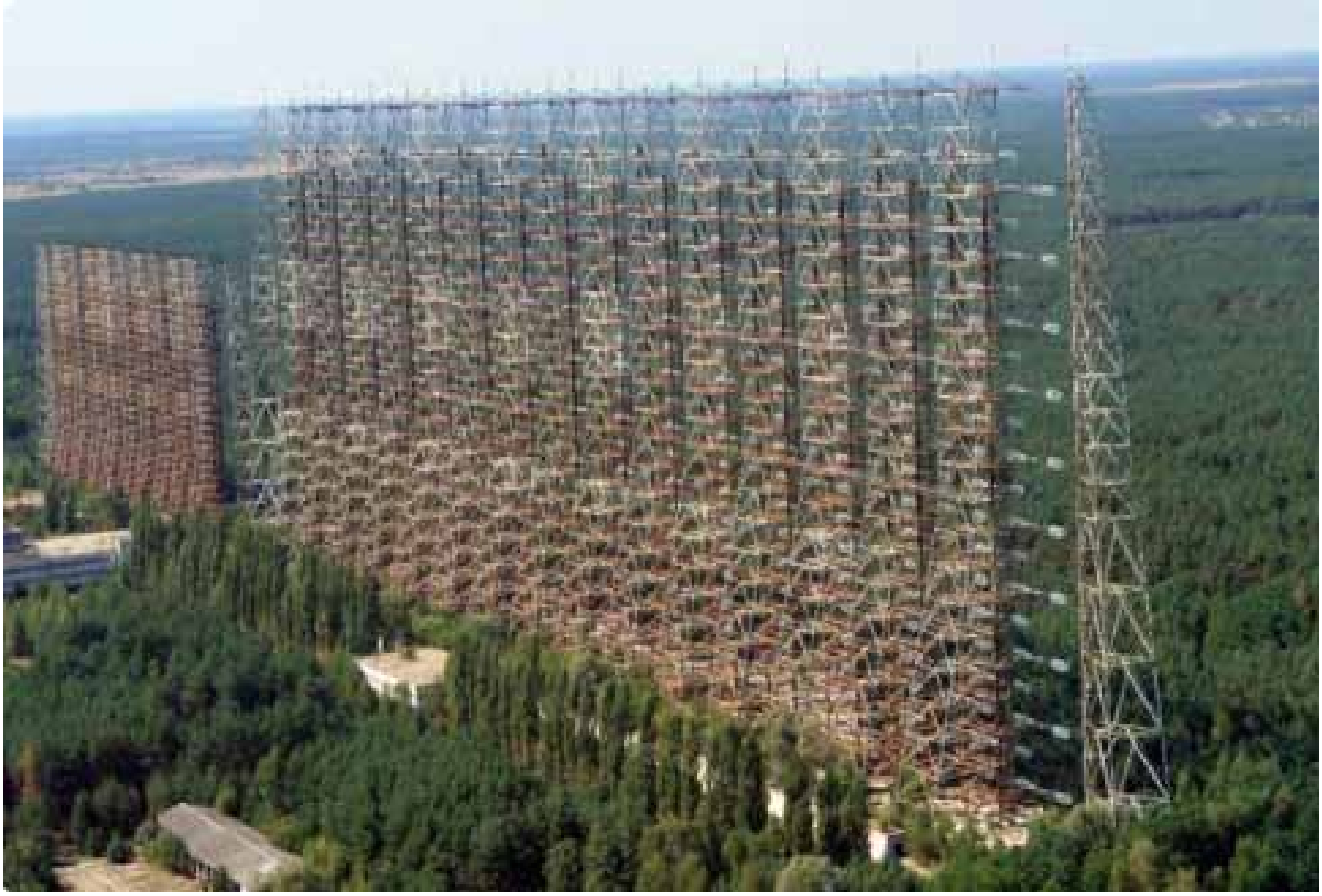
Zoom details have been released via the WVARA email reflector. If you aren't yet a WVARA member and would like to attend this month's meeting, feel free to contact me via k6ei@wvara.org for the Zoom meeting details.

At this month's meeting, Keith Snyder (KI6BDR) will give a virtual presentation on the Russian Woodpecker Over the Horizon Radar – A Real Blast from the Past. I'm really looking forward to this one since many of us older hams remember encountering this signal on-the-air.

In addition, Steve KC6ZKT will give us an update on plans for Winter Field Day and how you can get involved. (Winter Field Day will be January 30/31).

Jim, K6EI
WVARA Vice President

Russian Woodpecker Over the Horizon Radar by Keith Snyder, KI6BDR



Hidden deep in a serene forest yet taller than the clouds, standing in surreal beauty is an antenna array like none other on earth, having an aperture area greater than 15 U.S. football fields. One of the great wonders of the world – a top secret Soviet HF radar, so secret that even the name is uncertain, for it had many. It was the Russian Woodpecker. It was the Steel Yard. It was Duga.

The story of this top secret place is one of mystery and intrigue. Now abandoned, a rusting testament to man's cold war hubris, almost all popular accounts on the web are seriously flawed – victims of deliberate disinformation. Where did it come from? What did it do? Did it transmit? Did it receive? Was it the first of three, or the third of two?

About our speaker: Keith Snyder, KI6BDR, has been busy reverse engineering to uncover truth before time erases history. Keith shows visible engineering clues that reveal the mission and correct the history of the huge "Duga 3" antenna array. The Duga 3 is located a few kilometers from the Chernobyl nuclear power plant site. Although it has fallen into disrepair, it stands today due only to a hasty exit forced by radiation from the Chernobyl nuclear accident. The nuclear accident ironically protected the array from dismantlement, a reprieve from all but the ravages of time. The antenna array today attracts tourists who visit Chernobyl. It is one of the 8th Wonders of the World due to its titanic size.

New Members:

The following new members joined WVARA recently:

Bill Gingras, KB6YHL

Edward Souza, KN6KOZ

Welcome!!!

2020 Field Day Results

The December issue of QST is now online. Field Day results start on page 69. WVARA is listed with 18 logs and 18,212 points. There are literally hundreds of clubs listed and it looks like our combined score is good for about a top 30 finish nationally and #1 among California clubs.

Congratulations to all!
73, Mark W6IA

WVARA Net Check-Ins (W6PIY) **Tuesdays at 8:30 PM**					
Call Sign	**Name**	**10/13/20**	**10/20/20**	**10/27/20**	**11/03/20**
Total		**18**	**15**	**17**	**11**
AF6AE	Bill	X	X	X	X
AI6NT	Henry				X
K6EI	Jim	X			
K6QFO	Mike			X	
KC6ZKT	Steve	X	X	X	X
KD6WJV	Larry	X			
KF6EMB	Svend	X	X	X	X
KJ6CW	Jim		X		
KK6HPF	Ross	X	X	X	X
KK6VF	Kevin	NET	NET	NET	NET
KM6CLK	Bart		X		
KN6KHV	Scott		X	X	
KX6B	Dick	X	X	X	X
N6BTU	Wayne	X	X	X	X
NN6D	Andrew				X
W6BG	Max	X		X	
W6ESL	Tom	X			
W6IA	Mark	X	X	X	X
W6MNL	Steve	X			
W6PGC	Pat	X		X	
W6PK	Phil	X			
W8RJL	Ron	X	X	X	
WB6JHI	Steve			X	
WB6KHP	Dave	X	X	X	X
WR3K	Greg		X	X	
WR6Z	Dave	X	X	X	

Solar Forecast by AJ6X

November 09, 2020 blaj@ieee.org

Summary

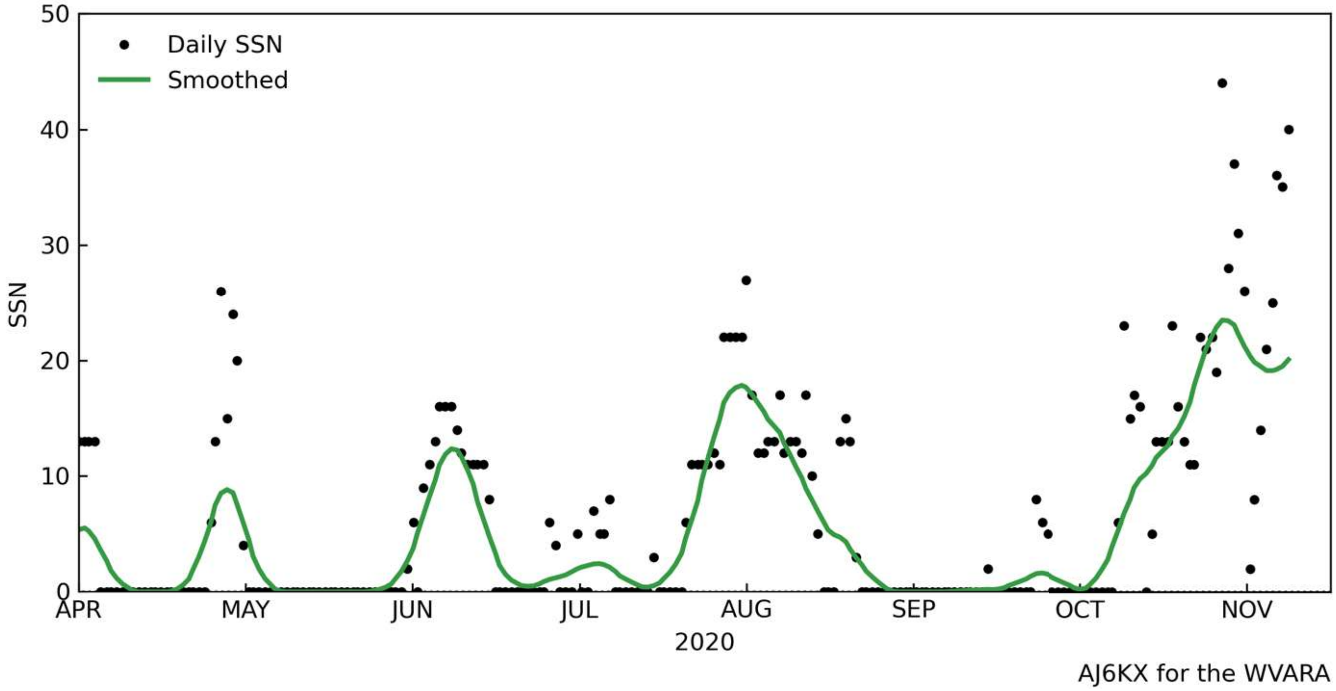
Most solar forecasting experts, using a wide range of forecasting methods, agree that solar **Cycle 25** will be similar to **Cycle 24**. Historical solar activity data is easily available, with monthly recorded observations since January 1749.

Using a powerful and relatively new analysis approach based on recorded trends in the sunspot time series, I am forecasting a **Cycle 25** similar to **Cycle 24** (slightly weaker). This is in agreement with the consensus forecast.

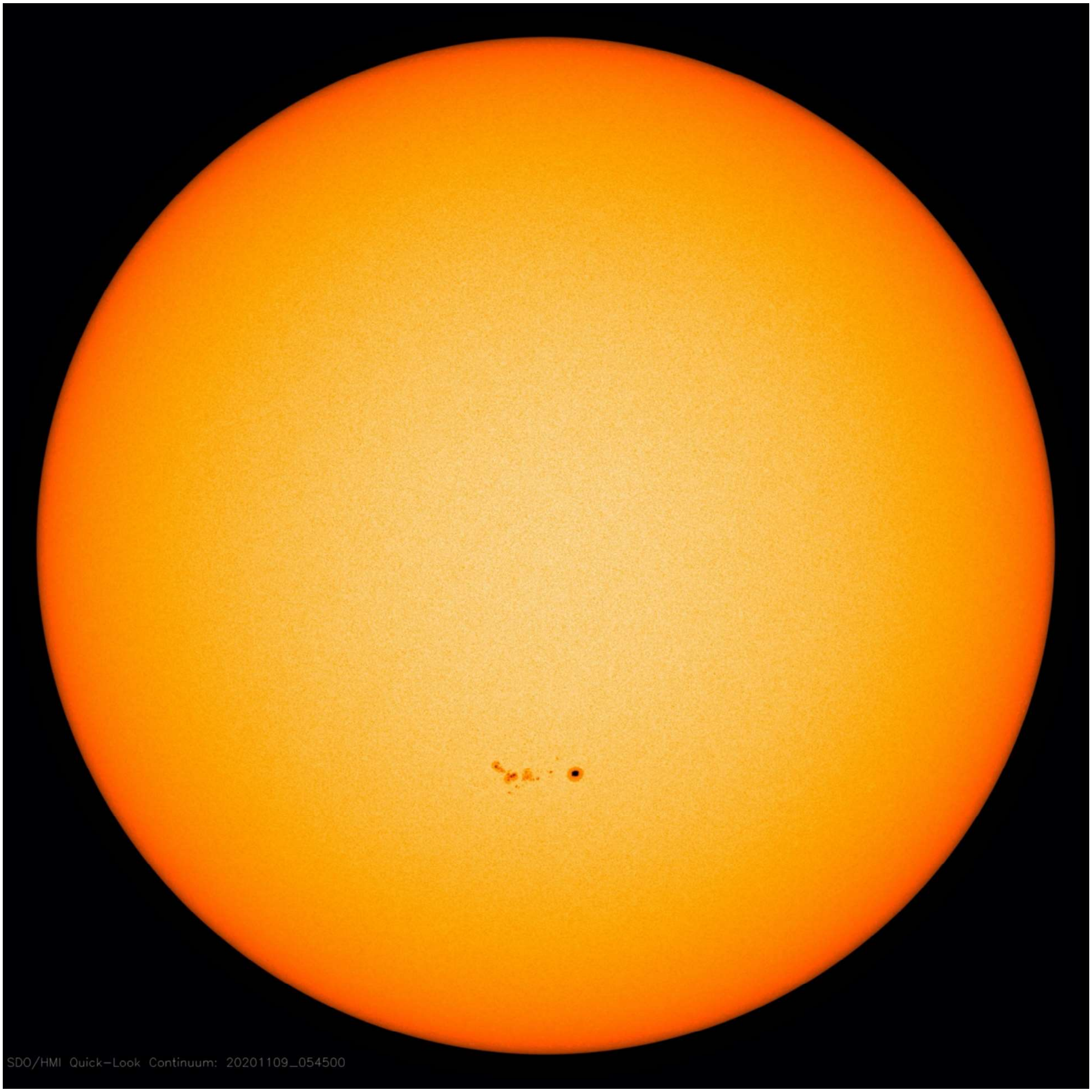
In July 2020, a new paper forecasted that **Cycle 25** will be one of the strongest ever observed, with an amplitude of the smoothed solar spot number of **233**! This resulted in enormous interest in the ham radio community, and especially the long suffering DXers. Extraordinary claims require extraordinary proofs. Let’s revisit this forecast using all the solar spot numbers collected up to today.

Sunspot Number

After promising starts in June and late July – early August, the sun has been unusually quiet through mid-October until the activity suddenly picked up again, exceeding a spot number of **40**. Last time the daily spot number was that high was in June 2018.



Solar Cycle 25 starting at its own pace: after an unexpectedly quiet September, the last several weeks the solar activity reached levels last seen in June 2018, dramatically improving HF propagation



The sun on November 9, 2020 UTC, with long expected activity; the solar spot number is 40

The provisional mean sunspot count for **November 2020** is **22.6**, with a smoothed value of **12.8**.

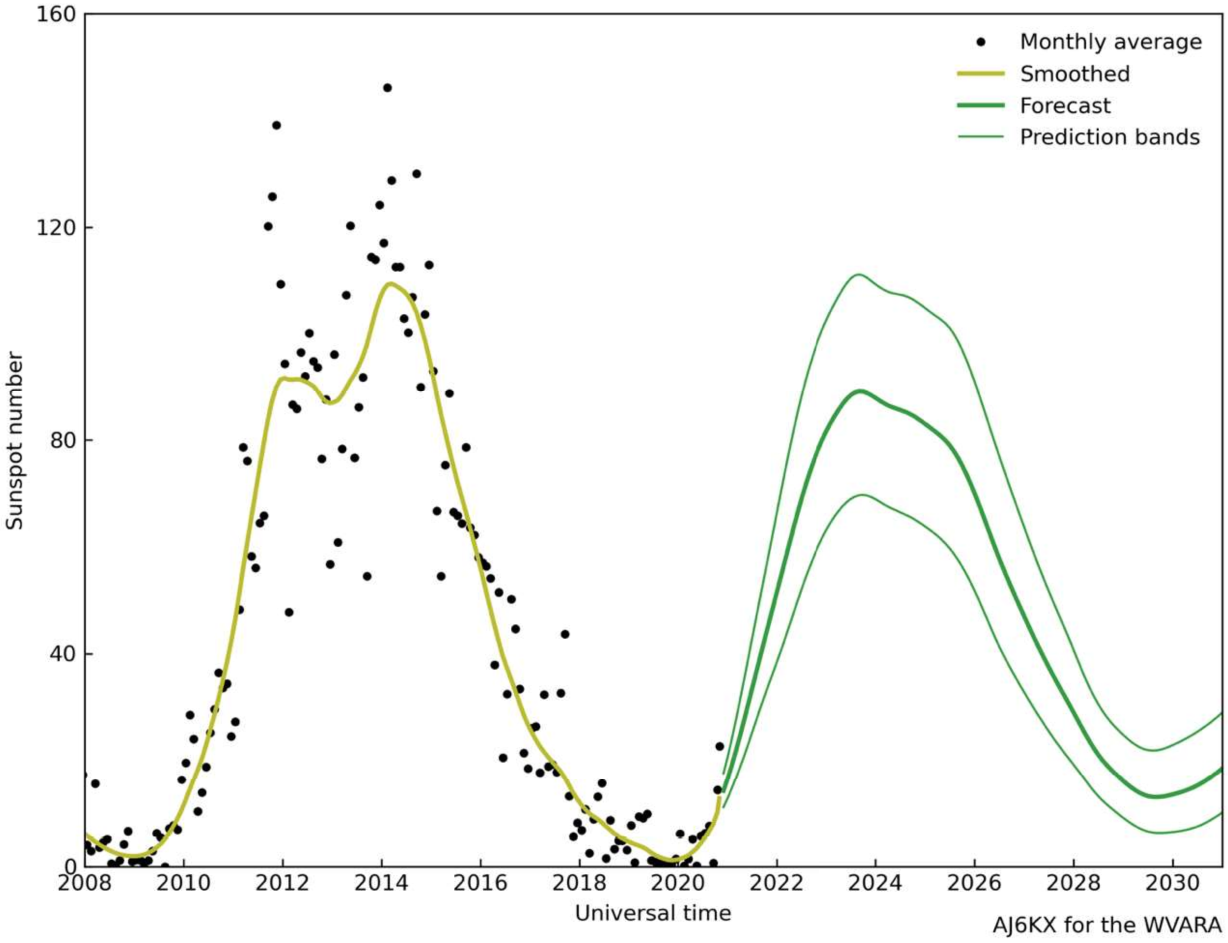
You might notice that my smoothed numbers are different from the typical smoothing with, for example, a 13-month running average. Instead of waiting 6 months for smoothing today's data, I prefer to use a more powerful smoothing (based on Singular Spectrum Analysis) that yields a reasonably accurate smoothing today.

Sunspot Forecast of Cycle 25

The new **Cycle 25** started in **November 2019** from a low of **1.2**, raising some hope in the long suffering DXers. It could peak in late **2023** or early **2024**, with a smoothed sunspot number between 68 and 113, with **88** the most likely.

This would be lower than any sun cycle in recent memory, and slightly lower than the previous **Cycle 24**. It is comparable to **Cycle 6** between **August 1810** and **May 1823**, when there were obviously no DXers to witness it. Actually, there were no radios either: radio waves were discovered in 1886 by Heinrich Hertz and the first radios were developed in 1895 by Guglielmo Marconi.

I expect this cycle to end in late **2029** or **2030**. Intriguingly, the next minimum could be better than recent ones, bottoming out at around **13**, similar to the bottom of the solar cycle in **1976** and better than any other since then.



Smoothed Cycle 24 and forecasted Cycle 25 using data up to July 12, 2020

Monthly Smoothed Sunspot Forecast

Month	SSN	±	Previous Forecast
12/2020	14.2	3.4	13.6
01/2021	16.5	4.1	15.8
02/2021	19.0	4.9	18.2
03/2021	21.7	5.8	20.7

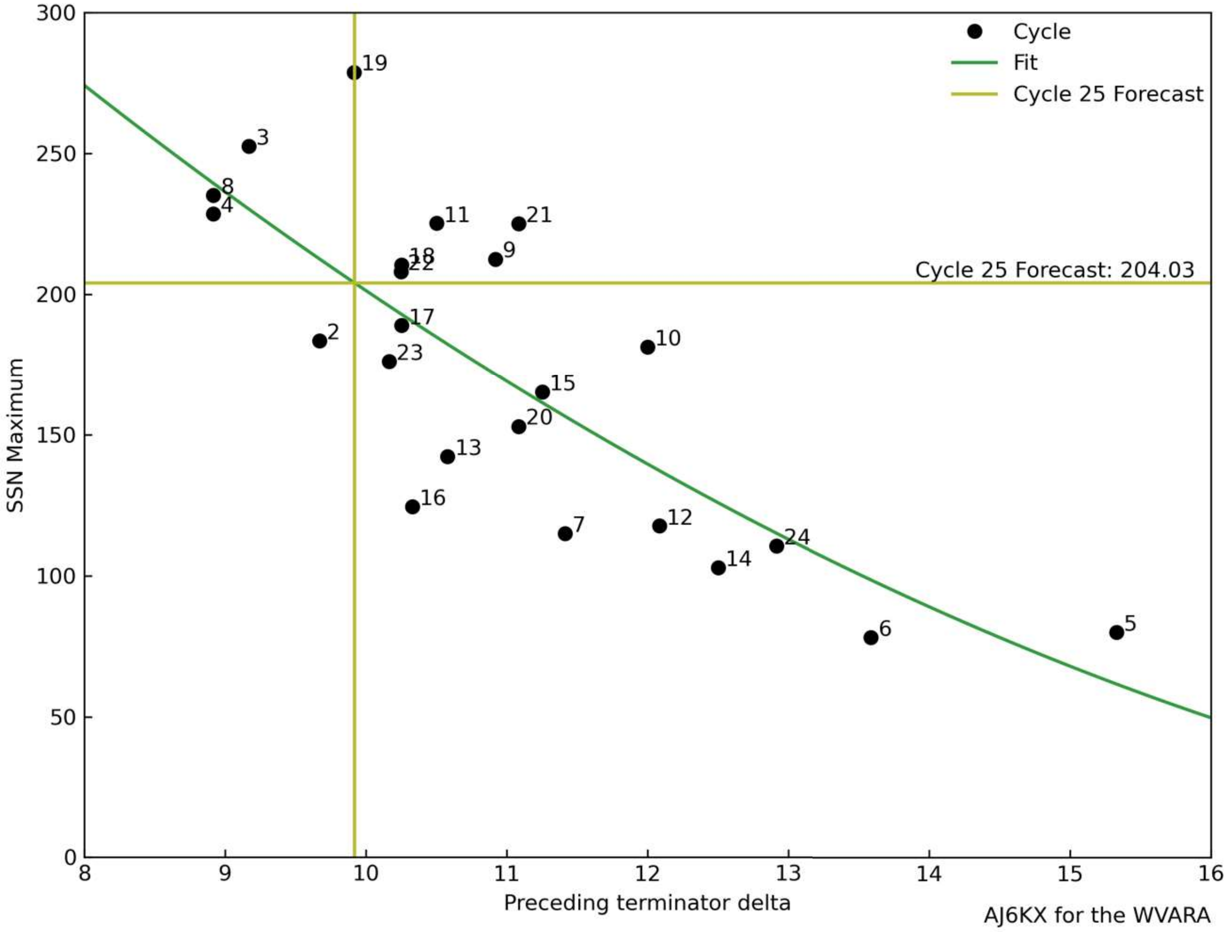
04/2021	24.6	6.7	23.4
05/2021	27.6	7.6	26.1
06/2021	30.6	8.5	28.9
07/2021	33.7	9.4	31.6
08/2021	36.7	10.3	34.4
09/2021	39.7	11.1	37.1
10/2021	42.7	12.0	-
11/2021	45.7	13.0	-

A Completely Different Sunspot Forecast for Cycle 25

Science is wonderful: with insufficient data, contradictory conclusions can be reached at the same time! 1,000 years from now, we'll have more data to accurately forecast the sun cycle. Until then, here is a delightful new forecast going against the consensus:

This paper: https://arxiv.org/pdf/2006.15263.pdf uses a different method to reach a forecast counter to the consensus. Accordingly, Solar **Cycle 25** is predicted to be one of the strongest ever measured with a smoothed peak of **233**! This would be stronger than any cycle in the last 150 years, except **Cycle 19** from **April 1954** to **October 1964**!

Let's review the paper. I took the liberty of following the same approach, with some minor changes (improvements of course!). Here is a summary plot:



AJ6KX for the WVARA

SSN maximum as a function of the preceding terminator delta

For Solar Cycle 25 we obtain an amplitude (maximum of the monthly average) of **204**. With the error in prediction, it could be as low as **170** or as high as **270**. So here it is, the new cycle starting now is either very weak or very strong.

There is reason for hope! In the next few months, it should be clear which way the Sunspots are going. I do hope the Sun is listening to this more optimistic forecast.

Technical Details

For those who like data crunching, the authors' main approach is:

1. Use the terminators, or dates of reversal of Sun's magnetic poles (22 year Hale cycle), with data available from **1891**. Each reversal coincides with a rapid increase in solar activity
2. Use the monthly Solar Spot Number data to predict reversals of magnetic poles for previous Solar Cycles, going back to **1757**. The prediction is based on the SSN phase extracted with a Hilbert transform.
3. Cleverly noticed that the interval between two terminators is a reasonably good predictor for the amplitude of next cycle
4. Estimate the next terminator (likely before the end of 2020)
5. Estimate the maximum of the monthly average Spot Number for next **Cycle 25**.

I took the liberty to process independently the same data. Points 1. and 2. work beautifully, as shown in the figure on the next page. The top panel shows the monthly Sun Spot Number, smoothed data, and trend. The second panel shows detrended data (necessary before calculating the Hilbert transform).

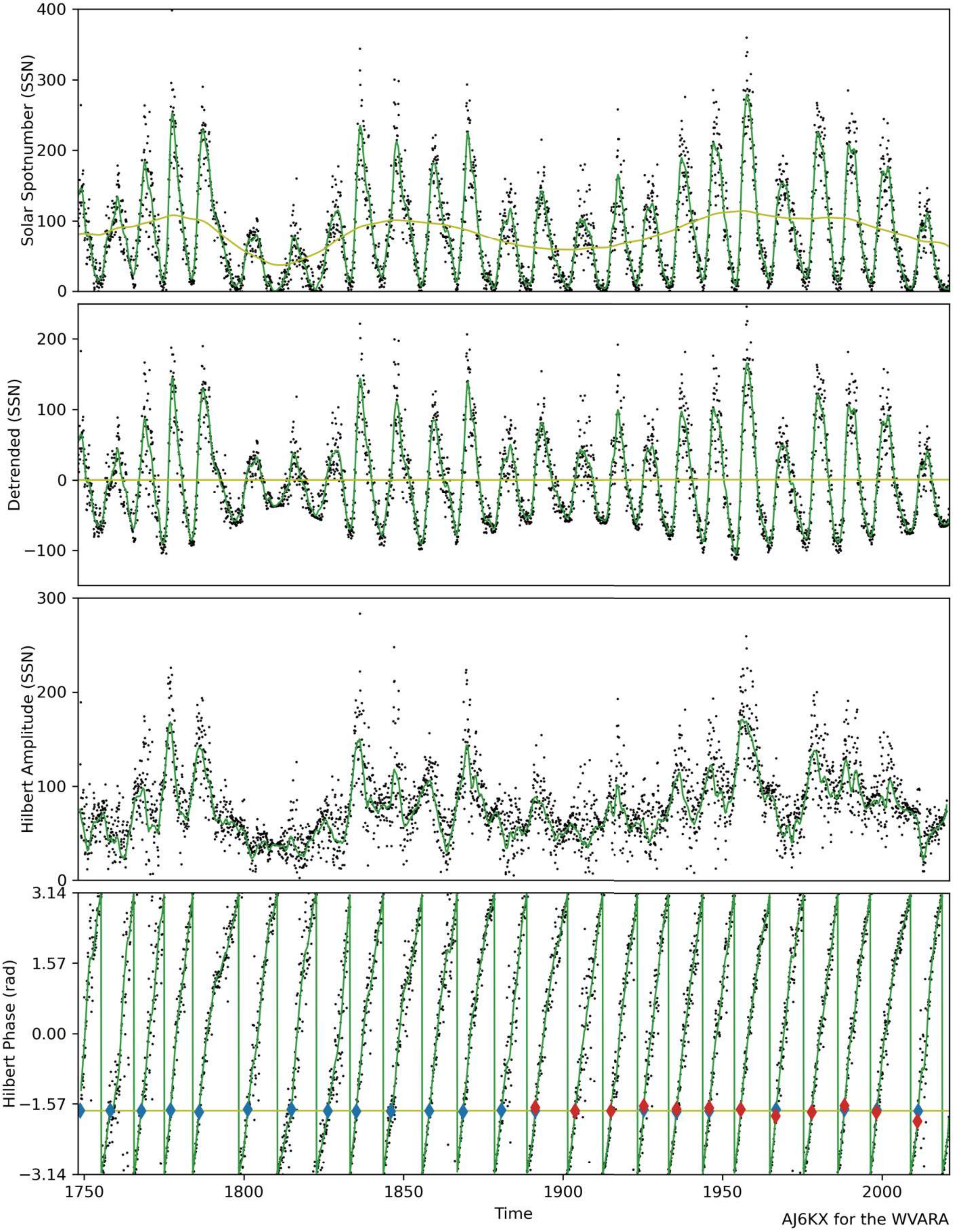
Next 2 panels show the resulting amplitude and phase obtained with the Hilbert transform. Red diamonds show previously obtained terminators, and blue diamonds show predicted terminators. Note the excellent overlap between the red and blue diamonds.

We can also use this to estimate the next terminator: extrapolating the phase, the next reversal should happen around **December 2020**, for a terminator delta of **9.92** years. This is indeed one of the shortest terminator deltas.

Now let's look at the relation between the intervals between terminators and next cycle's amplitude (figure on previous page). There seems to be a relation between the terminator delta of the previous cycle and the amplitude of the current cycle! It's not very precise but we can work with it.

We can fit it with a line. (Yes indeed, the line is curved! That's because Sun Spot Numbers are highly heteroscedastic, while fitting works best with homoscedastic data. A way to fix this is to calculate the Anscombe transform of SSN, perform a linear fit, and then take the inverse Anscombe transform.)

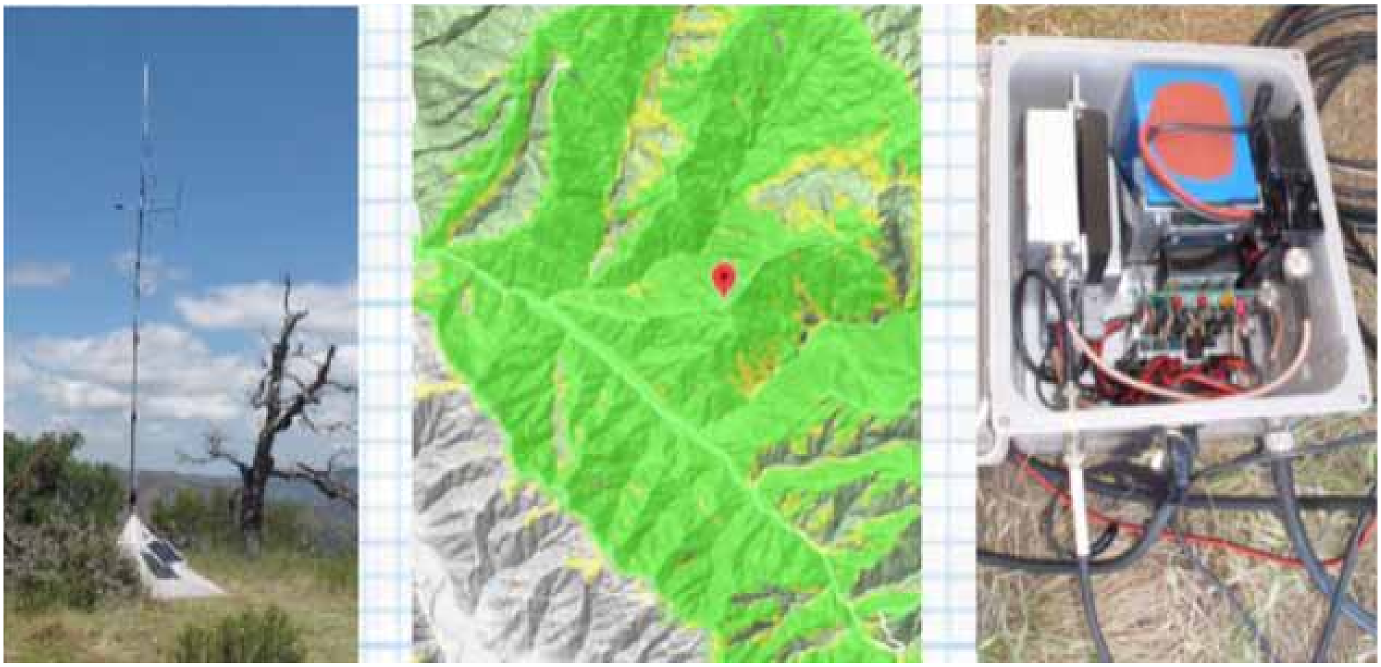
Plugging in the terminator delta for the previous cycle, we obtain an amplitude forecast for **Cycle 25** of **203**. It's close to the **233** in the paper. I do hope this works. We'll find out soon enough!



Detailed analysis of the SSN and magnetic terminators

WVARA's December Meeting

WVARA will not be holding a holiday party this year. Instead, we will hold a standard monthly Zoom meeting on Wednesday, December 9. Steve Sergeant, KC6ZKT, will tell us about: “Repeaters To Go… Wild”.   Zoom details will be released via the WVARA email reflector. If you aren't yet a WVARA member and would like to attend this meeting, feel free to contact Jim Peterson, K6EI, via k6ei@wvara.org.



Summary: What if you're organizing a back country event where there is no communications infrastructure? It's the kind of problem that amateur radio operators are uniquely suited to solve. What if your repeater site is only accessible on foot? Then you need a portable repeater system that can be carried to site in a backpack. Steve will talk about design requirements for highly portable repeaters systems, and show and demonstrate two 70-cm systems he has built for public service events, and review events where they were used.

About our December speaker: Steve Sergeant is a third-generation ham. Originally licensed Novice class in 1972, his licensed expired, but in 1991 he was granted KC6ZKT as a Technician and has since upgraded to Extra. Steve has a long career in audio engineering for professional and later consumer audio system integration. He currently works at Dolby Laboratories as an Applications Engineer. Steve is on the boards of the WVARA and the Nature Sounds Society. He is also a volunteer backpacking instructor for the Sierra Club, who teaches ultralight techniques, and a Uniformed Volunteer for California State Parks at Henry Coe State Park.

Jim, K6EI
WVARA Vice President

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